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Devices for Scrubbers, Etc.

[The subject of scrubbers being one that is now occupying very much of the attention of practical men in the fraternity, we have thought it would not be without interest to reproduce some sketches illustrating devices sent to us by a correspondent lately applicable in this direction, and which seem to promise well.—Ed.]

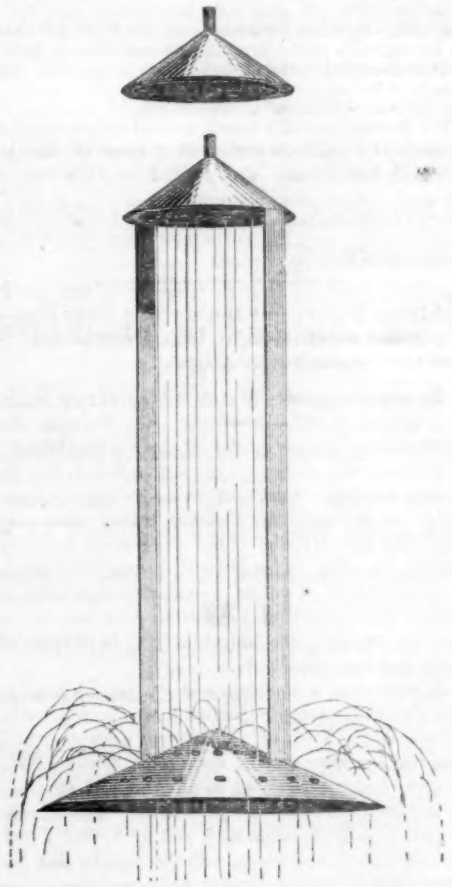
Gallipolis, Ohio, September 25, 1871.

Mr. Editor: I was very much interested in the communication from Mr. Somerville, of Dublin, on the cause and prevention of choked ascension pipes. I do not agree with Mr. Somerville or Mr. Anderson but with Mr. Hodgson Jones, so far as having the gas pass freely from the retorts. I have experienced the same trouble, so much so that it was not safe to leave our retort house for even a few minutes. We have had each retort to stop up three and four times in one charge of four hours, and I do not believe the cause is from high heats, for I run my retorts pretty hot, and charge each one every four hours with 175 lbs. of Pittsburgh coal (our retorts are of clay, eight feet long), which is rich, and gives off gas freely, and have a tendency to stop any stand pipe if not kept clean.

The remedy is to keep the stand pipe open, and for this purpose at first we used a rod with a button on one end, which would merely make a hole, and not clean the stand pipe as it should be, for there is not anything about a retort house that requires as much care as they do. One of my stokers had an instrument made, which when pushed up and pulled down the stand pipes, cut the burnt or charred tar out clean and smooth, leaving the pipes clean as when first put up. Since using this cutter, which is now ten months, we have not had one to stop up. I feel safe in letting the stoker go out to attend to other work. When the lids are removed from the retorts, there can be seen festoons of burnt tar hanging down from the edges of the stand pipe, where, if it had not been cut out clean when the stoker drew his charges, the tar would have collected around the edges little by little, and finally be stopped up tight; and it does not take long to do it either.

Our stand pipes are four inches diameter, and four inches from front of bench. I would say that we have no exhauster; our pressure is 24 10ths.

I have a sprinkler which I think will stand the test; it is simply made in this way. Take a piece of slate, about four inches in diameter, and drill a few very small holes in it; next make a funnel and put it in the bottom in the engraving; any tinman can do the work. I also show you the side view, with two strips one inch wide and fifteen inches long, soldered to the under side of funnel, and to another funnel-shaped piece very flat, and with two rows of holes, of one-



fourth inch diameter, which is to let some of the water through near the center; the water falls upon this funnel and is spattered all over the inside of washer. This sprinkler is placed in the top of washer, and so far it works excellently. The metal used is galvanized iron. Hoping that this idea may be of use to the fraternity, I remain yours truly,

James Hannan.

To Gas-Light Companies.

Odiorne's Patented Seal for Gas Works.

Since the notice in the Gas-Light Journal of 17th July, 1871, of my patent for a "Seal for Hydraulic Mains in Gas Works," I have observed that increased attention is given by those interested in gas making, to the means of preventing the deposit of carbon in clay retorts; and that several new methods of accomplishing this desirable object have been added to the contrivances already before the public.

It is claimed (justly no doubt) for all of these inventions that they prevent the accumulation of carbon, and it is now certain that this success is owing in a great degree, if not entirely, to the prevention of the *intermittent* pressure within the retorts, which was unavoidable with the old continuous hydraulic seal.

It is now established beyond doubt, that it is greatly to the interest of all gas companies (whether using exhausters or not) to adopt one or another of these means for accomplishing this desirable object; and I would respectfully suggest to them that before adopting any plan, they carefully examine them all. Any intelligent gas maker, by a study of the descriptions of these inventions, which have appeared in the Gas-Light Journal, will be able to select the best. I am quite willing to submit my invention to this test, as I have every confidence that the decision will be in my favor.

I propose to rest the matter on this basis; and now make my last public appearance before gas makers, by stating my terms for the use of my patent, which I have not before done.

I will furnish, ready for use, with directions for putting them up, all the fixtures required for a bench of three retorts for $25—the simplicity of my apparatus justifying this small charge; and for $20 for each retort in use, I will allow the use of my right during the existence of my patent.

Comparison with the rates of other inventions will show that mine is considerably lower than any other.

For an illustrated description of my improvement, I refer to the American Gas-Light Journal of 17th July, 1871, and I will furnish a limited number of copies thereof, on application.

Persons desiring further information in regard to my improvement, are invited to address me by letter to Springfield, Ill. Alfred Odiorne.

How Inventions Are Made.—Accident Versus Work.—Prof. Phin in the *Technologist* for February, writing on this topic, says:

Apples had fallen and chandeliers had vibrated for ages, and no result had followed, though both had been watched by thousands of listless and curious eyes. It was not the apple or the chandelier that originated these discoveries, but the mental training of Newton and Galileo. The converse of this is well shown in the history of the numerous inventions that are being constantly brought out. It is unfortunately true that the greater number of these inventions are made "by accident," and what is the consequence? Nineteen out of every twenty never pay the cost of taking out the letters patent. It is against this "accidental," haphazard course that we desire to warn our young men. If they would make inventions and improvements that will bring them honor and money, they must work hard and study their subjects thoroughly. This is the lesson which is to be drawn from the history of all the great discoveries ever made.

Chemical Repertory,
No. 56.—October 2, 1871.
EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

68. Whelpley and Storer's Rotary Pulverizers.—From the *Jour. of the Franklin Institute*, we copy the following statement of the inventors of these peculiar machines:

"The 18-inch pulverizer, commonly applied to furnaces, reduces 200 pounds per hour of anthracite coal, the proportion of size being about like the yield of mill-stones. It requires about 3½ horse-power to effect this. The same power reduces 300 pounds of bituminous coal, a large proportion of it being very fine. The entire yield will burn easily, wafted through a hot furnace. A 42-inch pulverizer, requiring about 15 horse-power, will deliver 1000 to 1200 pounds of anthracite per hour, 2000 pounds of bituminous coal, 2500 to 3000 of quartz, 2000 to 2500 pounds of top cinder, 3500 to 4000 pounds of limestone, 900 pounds of unburned bone, and 50 bushels of wheat. With an increase of power we have ground one bushel of wheat per minute, finer than is done with mill-stones, and 6000 pounds of copper ore in limestone gangue."

"A comparison of these figures with stamp-work, or any other method of pulverizing, would show very great economy, whether in cost of machines, attendance, wear and tear, or power consumed."

68. Fusion Points of Fats.—The author of this paper states that fats exhibit two different temperatures of solidification (*Erstarrungspunkte*)—one a natural, and another which might be termed artificial—the former of which, although not exactly coinciding with the fusion-point, is, at any rate, the most constant, and more readily determinable. The author points out the very great discrepancies existing between the various observations made by different authors on the fusion-point of the same kind of fat, adducing, as an instance, that beef suet, according to some authors, fuses at 37·6 deg., and, according to others, at 59·6 deg., and the same holds good for other fatty bodies, inclusive of Japan wax.

70 To Remove Foul Air from Wells.—The *Manufacturer und Builder* tells us that "to remove the gas before descent is made into any well, a quantity of burned but unslacked lime should be thrown down. This, when it comes in contact with whatever water is below, sets free a great quantity of heat in the water and lime, which rushes upward, carrying all the deleterious gas with it; after which, the descent may be made with perfect safety. The lime also absorbs carbonic acid in the well. Always lower a light before descending; if it extinguishes, there is still danger of suffocation.

[We would ask what is to be done with the caustic lime-water remaining in the well? We should prefer the other well-known plan of lowering and raising repeatedly, a bundle of straw.—Ed.]

71. Whittle's Plan for Preventing Deposit and Incrustation in Steam Boilers.—Consists in placing loosely inside the boiler a lining composed of thin iron plates, extending over the entire heating surface of the boiler nearly up to the ordinary water level, with a uniform space of a few inches left between the boiler plates and the lining, for the circulation of the water. In the bottom of the lining are made openings, or a single long slot, round the edges of which the lining plates are turned up to some height, so as to prevent the mud that collects inside the lining from passing out through the openings with the circulation of the water. In the comparatively quiescent water inside the lining, the earthy precipitate settles down to the bottom of the lining, where it remains harmless in the form of soft mud which never comes in contact with any part of the boiler heating surface, and is got rid of by blowing off at regular intervals as it accumulates.—*Van Nostrand.*

72. Indellible Inks.—The cheapest material for marking linen is coal-tar, diluted with benzine to the proper consistency. Another inexpensive preparation is to place iron filings or old nails in strong vinegar; let them stand many days and filter the liquid. Another way is to take equal quantities of vermilion and copperas, and rub them up with some oil varnish. The first and last preparations have to be used with a fine brush; the second, with a common pen.—*Manufacturer and Builder.*

[We should fear, with the second preparation, that *holes*, instead of marks, would be the result, in time.—Ed.]

73. Changes which Flour Undergoes when Kept for a Length of Time.—Dr. Poleck.—The author has instituted a series of researches with the view of ascertaining the cause of the difference exhibited by flour preserved in casks, and that kept in bags, the former of which often obtains a peculiar smell. The author found that the gluten of flour exhibiting that peculiar smell had been, in a great measure, converted into a soluble modification, whereby the flour had lost the capability of being converted into a good dough, the flour also having assumed a sour reaction. The author ascribes the cause of this change to want of a sufficient circulation of air through the mass of the flour kept in casks, the innermost flour in which was most sour and gave off the peculiar somewhat mouldy smell. It was also found that, with this change in the flour, coincides an increase of the albuminous compounds therein soluble in water.—*Chem. News.*

74. Functions of the Skin.—The *Manufacturer and Builder* tells us that if a coat of varnish or other substance impervious to moisture be applied to the exterior of the body, death will ensue in about six hours. The experiment was once tried on a child at Florence. On the occasion of Pope Leo the Tenth's accession to the papal chair, it was desired to have a living figure to represent the Golden Age, and so a child was gilded all over with varnish and gold leaf. The child died in a few hours. If the fur of a rabbit or the skin of a pig be covered with a solution of India rubber in naphtha, the animal ceases to breathe in a couple of hours.

75. Necessity the Mother etc.—A rather singular invention for remedying the actual want of fuel in private houses became very popular in Paris during the siege. They prepared cylinders of clay impregnated with bituminous substances; these combustible cylinders were used like the ordinary charcoal which is necessary in Parisian cookery.

Address Delivered before the New England Association of Gas Engineers,

On the 25th of July, 1871,

By the President—William W. Greenough.

Gentlemen: It is my official duty, as it is my pleasure, to welcome the members of our association to this, its second meeting. I am glad to see so many present from our different New-England States. One may hope that this meeting is but the prelude to many others which shall be fraught with interest and instruction, and which, from the contributed experience of various departments of engineering, may remove, or assist in removing, the difficulties lying in the path of every member of this body.

It may seem a superfluous duty, on my part, to undertake a discourse in general terms, in relation to our specialty. Each of us lectures, each day, to a larger or a smaller extent, upon some branch of the subject, and not always to so pleasant and attentive an audience as at present listens to me. But it is the general aspects of our position and work, that I wish to contemplate, and to see, with the routine that lies before each one of our number, what steps forward are to be taken, and how one may safely move on to the satisfactory fulfilment of his allotted duties.

The manufacture of illuminating gas from coal has resolved itself, since the discovery of the process, into a series of appliances, made use of, in one form or another, in most gas-works. When one mentions the retort, the hydraulic-main, the condenser, the scrubber, the washer, the exhauster, the purifier, the station-meter, and the gas-holder, he has placed in line the series of preparations for a contingently adequate and satisfactory delivery of the product of the manufacture, to the street-mains and supply-pipes which conduct it to the consumer. These applications, varied in power and extent, and differing in structure and principle, are common to most gas-works. We may examine, in detail, how far this series of processes answers the just expectations of the engineer who is resolved in his own mind to do his duty faithfully in his manufacture, and to supply to his consumers the best quality practicable from the materials and with the mechanical contrivances afforded him. His machine is considered to be complete. There is placed under his control, with which he is expected to attain the best results, machinery, more or less perfect in structure, which is only changed or enlarged for the purpose of correcting some experienced imperfection, or to meet the requirements of an increasing consumption of his product. He is compelled to employ to the best advantage the instruments not unfrequently provided by others, whether well or ill adapted to the work before him. He usually can make gas, and sufficiently purify it and prepare it for use, with the means that are afforded to him. But how far this falls short of his ambition and of his conscientious duty! Retorts unsuited to his coal, worked at improper heats; condensers insufficient or too powerful; scrubbers and washers equally injurious to his peculiar hydrocarbons; purifiers which leave sulphur and other impurities in some mysterious or inaccessible form—all these, and various other problems, are before the engineer to resolve as best he may, keeping before him constantly the purpose of obtaining the best result practicable with the machinery and the material provided for him. Over and beyond this comes the complicated question of pressures, controlled by the hills, valleys, and plains in his district, and by the size of the street and house distribution, in which all mathematical formulas fail him: and if, at the end of the year, he has given to every consumer all the gas required for his consumption, at the pressure best adapted for the economical use of the special gas manufactured, he has attained a result not yet, to my knowledge, reached in the administration of any gas works in the world.

But why are these difficulties stated, all of which and more are made known to you in your daily experience? It is because they are obstacles to be overcome. And how? By cautious experiment, by daily and hourly observation, by a careful adaptation within one's knowledge of means to ends, and by determining that no day shall pass without adding to one's stock of useful knowledge. No observing engineer can walk through either his own or another's gas works without acquiring the knowledge of some fact, perhaps apperently of trifling value, which he may not have known before. The results from the same coals and the same apparent processes are so different under the varying conditions of the atmosphere, of the changing states of the thermometer and barometer, that no day can pass without presenting questions which neither science nor experience has yet answered.

I was once told by a gas engineer in this country, that we were fifty years in advance of European culture in our specialty. When one thought, on the instant, upon what had been effected by Lowe, King, Barlow, Thompson, Kirkham, and Evans, in England; by the French, and other continental engineers—when one remembered the magnificent station at La Villette in Paris, and the Imperial gas works in London, it did seem, in comparison, that gas making had not quite reached its high, consummate growth in the United States. Whether foreign or American engineers attain the best results, from the very different coals which are afforded to them for the purpose of manufacture, is a question at present incapable of solution, and perhaps, also, useless to discuss; but one may see, in the discriminative and dissective examinations of the details of the whole subject, prevalent in Great Britain, France and Germany, that quite as much intelligence and science, to say the least, have been brought to the analysis of the problems of manufacture there as have been applied in this country. Without disrespect to our own people, it may be said, that one does not always rely upon the written or printed opinions of our own experts for the clearest and nearest approach to the knowledge desired.

Now, the gas engineer has to give his time and thoughts to the practical working out of innumerable scientific results. Every step in his manufacture is to be determined, limited, and controlled by various absolute laws, yet insufficiently explored, and nevertheless, to be measurably expounded, in default of actual knowledge, by his experience derived from observation and trials. One of the most distinguished English engineers, whose scientific acquirements, general knowledge, clear understanding, and sound judgment, justly place him in the front rank of our profession, once said to me in a tone of great disappointment, "I do not understand why I cannot attain the same results in my works as in my laboratory. The processes, so far as I can see, are precisely parallel, and yet the results in our various stations fall far short of those attained by me here." Yet his works were as well built, well arranged, and well administered as any works in the world. If this learned scientist, with all his powers of investigation, failed to satisfy himself upon this problem, it may relieve the anxieties of many conscientious workers in the same direction, who have found a painful discrepancy between theoretical ability and the actual practice.

In the application of science to the useful arts, the production of gas has a special reference to a single and important sense. It seeks to provide in the hours of darkness an artificial light, pleasing to the eye, sufficient for the purpose, inoffensive to the other senses, convenient, and economical. In simplifying

and perfecting this manufacture, and the details of its distribution, exact science has done much; but when one passes in review every step of the whole process, it will be found that science has hardly yet passed the threshold of its labor; that no chemical or mechaaical changes which go daily forward in all gas works are governed by laws absolutely known and fitted precisely to the conditions which the engineer is required to meet to perform the regular routine of daily duty.

To begin with the particular coal used for carbonization—What is the true heat which extracts from it the largest amount of the highest grade of gas which it is capable of producing? All coals differ, each from the other; coal from the same mine is often different at different depths and positions. There is no pyrometer, of easy and ready use, which shall give us the absolute heat of our retort, the evenness of its duration, or the possible variations of temperature, which may exactly indicate how the best results are to be attained. According to general experience, most ccals worked in this country give their best product, in quality if not in quantity, in four-hour charges at what is called, by a rule of the eye cherry-red heats. Others are said to do better at higher heats. As a general rule, it may be said, that the effort to produce quantity is made at the expense of the quality of the gas produced. Then, again—Is pressure on the retorts of consequence? If so, is it equally important in the working of every description of retort? Does its amount affect quantity, or quality, or both? What is the percentage of loss or gain, derived from the amount of pressure or want of pressure, as applied to the specific coal or retort in use?

Coming next to condensation, one remembers the old saying of the profession, that "gas well condensed is half made." But what is the precise amount of condensing surface which an engineer should apply to his daily work? Over-condensation is as injurious to the grade as under-condensation is to the purity of his gas. How shall he practically ascertain what he ought to take out by the process, and stop at that point, and continue to stop there, day and night, summer and winter?

In default of perfect condensation, scrubbers and washers have been provided. From dry scrubbers little harm has been experienced, when they have been simple mechanical contrivances to effect, by direct friction, the removal and deposit of certain oily and tarry matters carried in the flow of gas beyond the condensers. But when water is added, as in the form of wet scrubbers or washers, it has been found that, in the removal of ammonia and the mixed hydrocarbons, there is also carried away a valuable and important percentage of the illuminating power, and probably also of the quantity of gas made.

Then in purification—The supposed elements of the crude gas having been given, what is the material best adapted to remove effectually the combination of impurities with least injury to the quality of the gas? So far as the gas engineer is concerned, it is beyond his power and the contents of his laboratory to obtain exact knowledge of all the component parts of his gas, and to ascertain positively what should remain and what should be taken away. No chemist within my experience has yet gone through this exhaustive analysis of the crude, though Bunsen and Letheby have undertaken minute investigations of the manufactured gas. Practically the question is solved by the application of sufficient lime, wet or dry, or of oxide of iron, to remove the impurities most perceptible to the senses; but beyond that point it is now difficult to penetrate.

So much in these ways, and upon many other points, to which it is not necessary to allude at this time, has science yet to determine. They will all be practically solved according to the best of our knowledge, as they heretofore have been met, but with a present conviction that the laboratory of the chemist has been of less practical benefit in the past than may be reasonably expected in the future.

In this connection, and in view of our scientific schools, and having regard to the increasing and important extent of our manufacture and of its infinite convenience to the community, it would be well if special attention were devoted to this application of science; so that young men might be duly qualified by a course of study and experimental work for undertaking the profession which we follow. One may hope, that within a reasonable period a chair of experimental physics may be endowed in some one of our institutions, under which instruction may be given in our specialty, and young men of thorough preparation and culture become members of our body who will carry forward the details of the work to more perfect results than have yet been attained. No scientific knowledge will come amiss—natural philosophy, mathematics, chemistry, and mechanics may be absorbed with advantage in unlimited quantities.

These and other scientific problems are before the gas engineer. He is required to solve them practically according to his knowledge, his skill, and his ingenuity. If he keeps a record of his observations, he contributes data of value to himself and others. He must be systematic, watchful, and slow in arriving at positive conclusions. That so many works are well managed is an evidence of the faithfulness and care which have been devoted to the oversight and examination of the various processes of manufacture.

The protection afforded by the law to gas companies and gas consumers differs widely in most countries and states. In many communities, thero is no legislation directly affecting them; in others, provisions are taken for insuring a proper inspection of the measuring instruments by which gas is sold; in others still, legal enactments undertake to control quality, measurement, municipal responsibility, safety, and convenience, as well as many other minor points. The more minute they have been in detail, the more useless they have generally proved to the public and harassing to the gas company. In England, parliamentary committees are continually altering and revising the acts of their predecessors; and yet there is no law which is generally obligatory in its provisions for the whole of Great Britain. In the State of Massachusetts, the law upon the subject still stands without change, and is the oldest statute of which the original provisions remain unaltered. In all essential points it is sufficient; but modifications are needed in some of its details. As it now stands, it enjoys the great distinction of giving the first legal recognition to the principle, inseparable from justice, that the illuminative powers of every gas should be tested by the burner and at the pressure best adapted to it. This law passed in 1861, antedates by three years the first parliamentary legislation tc the same effect. The result of the establishment of this principle has been to produce, from the experiments of Dr. Letheby, William Sugg, and others, a collection and series of burners skilfully adapted to all grades of gas, and of great advantage to the consumer, no less than to the manufacturer. It is obvious to all, that it is for the direct interest of every gas-producer that his products should be used by his constituency with the utmost economy and with the best appliances; and attention to this point on the part of managers would save many complaints and obviate many prejudices.

From the peculiar character of its business, a gas company is properly and necessarily a monopoly. It is to be hoped that the days are past when an intelligent municipal government could tolerate the nuisance of mains, belonging to competing companies, in the same streets. As monopolies, they are naturally subjected to popular opprobrium, and their acts and doings are criticised with no friendly spirit. Conducting apparently mysterious processes, which, nevertheless, are perfectly intelligible to a common understanding, and which result in a sightless and almost imponderable product, sold for consumption by the measurement of a mathematical instrument, the whole manufacture and its administration are viewed with great suspicion by large classes of otherwise well informed persons, who take no pains to obtain correct information, or even to learn how to manage properly the fragment of the great machine which each has on his own premises. Besides this, gas companies are generally prosperous in their business: having before them the cost of their product, which varies in every locality, they endeavor to fix a selling price which may be fair, and tolerably permanent, and which will secure a moderate profit for the investment of the stockholders. At least, these are the conditions upon which most New England companies of which I have personal knowledge are arranged. Notwithstanding this fact, there is nothing which is more readily believed or which excites more unreasonable indignation, than the statement, without proof, or with small basis for assertion, that the profits of all gas companies are enormous. The question is frequently asked, "While gas in England is vended at so low a price, why cannot it be made and sold as cheaply here?" To this we answer, "Give us cheap labor, cheap coal, cheap iron, relieve us of senseless and oppressive taxation, and the selling price of our commodity will be reduced proportionately." Indeed, although exact comparisons between the economies of different countries are difficult, if not impracticable, there are sufficient grounds for believing, that, taking quality and cost into consideration, gas is sold as cheaply in proportion in New England as in Europe.

There is no defence of our interest necessary to be made to gas engineers. The profession is honorable, and of great service to the public. It opens a career which any young man may be proud to enter. Few manufactures unfold so wide a sphere for discovery and improvement. Every step in its future progress will be due to scientific advancement. These are facts known to you all, and only stated here as a part of the general outline of the situation, which it seems just to notice.

In conclusion of this very general survey of our position, and of the present condition of our manufacture, permit me to say, that there are no descriptions of companies for manufacturing purposes which have so many interests in common as gas companies. No trivial or unjust legislation elsewhere, but its provisions find their way to annoy us at home! No injustice or arbitrary conduct on the part of a gas company at a distance, but it is reflected on us here? No large profits accumulated by one corporation, but it is thrust in the face of all? It therefore behooves us, so far as lies in our power, to conduct our works not only as a monopoly; but as a trust, which, while it has rights, has also duties. If this principle is kept steadily in view, one may hope, that in the progress of years, the intelligence of the community will better comprehend and appreciate the efforts in this direction, now generally unrecognized. But in the future there is not likely to be any higher reward in the conscientious discharge of duty than the self-approval and self-respect which is its consequence.

British Association of Gas Managers, June 14, 1871.

[Abstracts by the Editor of this Journal.]

[Continued from page 86.]

ON COAL STORAGE AND SPONTANEOUS COMBUSTION OF COALS.

By Mr. A. H. Wood, of Hastings.

Although I have heard it argued that coal loses nothing by storeage, my experience goes to prove that there is a loss of value, either in yield or illuminating power, varying from 5 per cent. to 10 per cent., or even more, in long-stored coal, over the same coal received in good condition direct from the colliery.

There are, however, certain conditions which no doubt vary the losses which take place in warehoused coals—the original size of the sample of the coals, the grinding of them in warehousing and trimming, the tenderness of the sample, and, most particularly, the chemical constituents of the coal itself, some coal being much more tenacious than others, and these most probably suffer least. Enough, however, has probably been said in this digression to prove that the storeage of the coal in *good condition* is a subject worth consideration.

One of the most important points, however, in association with the storeage of coal is its liability to spontaneous combustion. Vessels have sometimes been lost with all their crews from this cause alone, and many gas managers have found large stores of coals dangerously heated, while others have gone a step farther and found them actually fired.

It should be the object, therefore, of every gas engineer, where a large store of coal is absolutely necessary, to see that they are carefully stored, and that such precautions are taken as to lessen the danger if not altogether prevent the possibility of spontaneous combustion. With a view to this end, let us just for one moment inquire into the cause of such a calamity, and it follows that if we can discover this we may then with a greater facility prescribe a remedy.

One of the most important causes (if we may not say *the* cause) is the presence of iron pyrites, and their absorption of atmospheric oxygen.

It appears that the white pyrites are more dangerous than the yellow, because they contain a mixture of protosulphuret and bisulphuret of iron.

I am indebted to Dr. Letheby for a very lucid, exact, and concise description of these transformations. The doctor says: "The white pyrites of the coal are a mixture of proto and bisulphuret of iron; these undergo oxidation on the access of atmospheric oxygen, and the protosulphide of iron is converted into ferrous sulphate (FeS $O^4$7HO), which is accompanied with sufficient heat, when the action is confined in the mass, to effect the further oxidation of the bisulphide of iron, and thus at last the heat rises to such a pitch as to fire the coal."

There is nothing peculiar in this generation of chemical heat during these transformations, as it is only an ordinary auxilliary in chemical combinations. Almost all oxidation is accompanied by it in some degree, the degree being dependent on the energy with which the combination takes place.

Now what is the practical inference to be drawn from this? If we know that the master cause of spontaneous combustion is from the presence of pyrites, why allow them to be stored with the coals? Why not pick them out as they are being stored? It is not a difficult task, and carters, trimmers, coal wheelers, and stokers are all willing to do their part (for a trifle per bushel), and jealous even of each other as to the quantity procured. I have now done it for some years, and have never found my coal heated since, to say nothing of an unquestionable advantage in the purifying process.

Another important feature in the storing of coal is that it should be stored dry. To say nothing of the inconvenience of having a lot of wet coal come out in the winter to knock down the heats in the retort house, it is an acknowledged fact that damp or moist coal facilitates the condition of things that I have been discussing—in fact, that moisture in the coal or in the

atmosphere with which the coal may be brought in contact tends to increase, if not at first set up, the oxidation of the white pyrites, and consequently chemical and spontaneous combustion. Brande, Muspratt, and Dr. Letheby, and in fact all who have given much attention to the subject, hold this view, and I believe it is the practice, in the manufacture of sulphate of iron from pyrites, to throw them in a heap and moisten them with water to facilitate the very oxidation which every gas manager would seek to prevent.

It follows, then, I think, from this that coal should be stored as dry as possible. I am quite aware that sometimes it is not easy to prevent damp coal being stored, but still something may be done by every manager to lessen, if not altogether prevent, the storing of damp coal.

One means that I have found to assist this end is to keep one warehouse for a more general store than others; in this store I work, both in and out, all the summer. If a sample of coal is not so good or dry as I could wish, it is put here, and used up quickly, only that which is thoroughly satisfactory being stored up for the winter. I am quite aware this cannot always be carried out, but I throw out the hint as being one means of getting a dry stock for the winter where it is practicable; and where it cannot be altogether carried out, it may partially, and even then it may be useful in preventing the coal from heating.

There is one other point I will just allude to—viz., that the warehouses should be so situated that they should not be subject to any auxilliary heat. I am quite aware that this remark will not apply to factories of any magnitude, but in many small and medium sized works the coal warehouse sometimes adjoins either the retort-house, a boiler-room, a smith's forge, or something similar, and the auxilliary heat through the wall tends, especially with damp coal, to set up the oxidation. I know one instance where it was unquestionably the case, and I therefore here just throw out the hint.

Mr. Hodgson Jones regretted that Mr. Wood, in his paper, had not touched upon the question of the ventilation of coal stores. It was an important matter, as, in his experience, he had known cases of combustion arising entirely from the want of sufficient ventilation. So far was it an admitted fact, that in France the insurance companies would not issue policies to cover stocks of coal, unless due attention had been paid to the proper ventilation of the stores.

Mr. Baker said, having had a coal-store on fire containing 800 tons or more, his attention had been forcibly drawn to the question of how to prevent the recurrence of such a calamity. He had found a very effectual means was to put down a number of empty hogsheads, here and there throughout the store, at the time the coals were laid in. This promoted ventilation, and the men were enabled to go down from time to time, and detect if there was any heat.

Mr. Fraser said, as a coal master and a shipowner, he had had some experience in this matter. Welsh coal was specially liable to spontaneous combustion. On one occasion he had a load of coal lying alongside another ship in a Welsh port. The hatches in the last named ship were put on night after night, and the consequence was that gas was generated, and the hatches were blown up. In his own ship the hatches were kept open, and a good deal of rain fell upon the coals. The captain took the precaution to use ventilators, consisting of long perforated tubes; but, before the vessel had arrived at Alexandria, heat had set up, and a part of the coal was almost on fire. Scotch coal was little, if at all, liable to spontaneous combustion. He never knew an instance of Fifeshire coal taking fire spontaneously, but after the seams were pretty well worked out, spontaneous combustion frequently took place. At the bottom of many of the pits there was a good deal of iron pyrites; and, though this did little harm of itself, the bed of shale overlying it sometimes fell, and then heat arose, the small coal around evolved gas, and in this way spontaneous combustion was set up. The miners had the first intimation of it from the white damp, which had a most poisonous effect upon them. It did not affect the lights in any way, but had a soporific effect upon the men. In consequence of the possible presence of this white damp, it was found absolutely necessary in some places, after the coal was taken out, to bring to the surface also all the pyrites; then no spontaneous combustion arose. With regard to Scotch coal generally, the only liability was to choke damp, which put the lights out. He had had 40,000 tons stored for a long time, and it never entered into his head to take any precautions against combustion, and he believed it arose very much from the fact of the small proportion of sulphur in Scotch coal. In order to detect the approach of spontaneous combustion in his coal-stores, Mr. Woodall, at the Phœnix Station, Vauxhall, put iron rods down through different parts of the coals. These rods were occasionally drawn up, and, if they were found to be heated, measures were at once taken to stop the combustion.

Mr. Hodgson Jones said he used baskets without bottoms to ventilate his coals, and he dropped a thermometer down them every morning to try whether heat was being generated. This was a more convenient means of detection than an iron rod.

Mr. Broadhead asked whether it would not be well to employ 8 or 9 inch pipes perforated with holes, and with good broad bases, and stand them up in various parts of the stores, so as to keep the whole well ventilated.

Mr. H Jones said that plan had been tried, and it was found, in several cases, that these pipes acted as chimneys, and the whole of the coal was burnt if combustion set in. If there were a fire in a store where baskets were used, the coal on the top falling in would choke the flame.

Mr. Ohren wished to say a few words in favor of ventilation. At his works at Sydenham he had twice had the misfortune to have coals on fire. About £150 worth of coal was destroyed, but the loss did not fall upon the company, as the coals were insured, and they received the whole value from the office. For the last three or four years ventilating shafts in the coal-stores had been used, and it was found by that means that if the coal was at all inclined to fire the gases passed off through the shafts. In fact, the result was perfectly satisfactory. He did not at all understand why, if 9-inch pipes were used as ventilating shafts, as Mr. Broadhead suggested, the coal should be more liable to fire. Mr. Jones said they would act as chimneys and create a draught, which would increase the liability. In his stores the ventilating shafts were made 2 feet square, and they were placed 25 feet apart all over the stores.

Mr. H. Jones said he made his remark under the supposition that Mr. Broadhead meant vertical pipes.

Mr. Baker said that if the shafts formed chimneys, there must necessarily be ventilation, because the cold air would come in at the bottom.

[To be continued.]

Condensed Abstract of the Gas Referees Report on Burners.

[By the Editor.]

[Continued from page 83.]

Every burner is fitted, and every scientifically constructed burner is expressly devised, for a certain rate of consumption; and to use a 6-foot burner with three feet of gas is as absurd as to use a 3-foot burner with six feet of gas. Hitherto sufficient attention has not been given to this matter (in the experiments of Christison, Farmer, and others, it was wholly overlooked); but in the construction of his new "London" argands Mr. Sugg has acted upon this right principle with great success—although there is still room for improvement.

Sugg's London Argands

are so constructed as to check the pressure of the gas "as delivered to the burner."

A series of experiments with several of these, which they then cite, sufficiently indicate that, throughout the common range of consumption, there is no difference whatever in the illuminating power of gas; and beyond all question they demonstrate the erroneousness of the doctrine that the light-giving power of gas increases in a higher ratio than the quantity of gas consumed. In fact the smallest burners here give the best results; so that, in these experiments, the gas gives *less* illuminating power when burnt in large quantity than in small.

The most cautious and moderate upholders of the doctrine that the illuminating power of gas is greatest when the gas is burnt in large quantities, maintain that, whatever be the rate of consumption, a fixed portion of the illuminating power of gas must always be lost, and that therefore it is advantageous to burn gas in large quantities. The explanation offered of this alleged fact is, that a *fixed* quantity of gas must be wasted, as regards its illuminating power—must be consumed simply to produce *heat* in sufficient amount to render the remainder of the gas incandescent and light-giving.

This hypothesis is totally opposed to the ordinary laws of nature. To suppose that, when the rate of consumption is four feet, as much of the gas must be wasted in order to produce heat enough to render the remainder of the gas luminous, as when the consumption is raised to double the quantity, is preposterous; for obviously there is twice as much gas to be raised to a state of incandescence in the latter case as in the former.

No burners have as yet been devised for the consumption of gas in very small quantities, nor are they much needed. But, lacking such burners, let us make use of a rude apparatus for diminishing the air-supply, viz., a metal disc placed above the upper end of the chimney of an argand—and observe the result. The burner to which it was applied was Sugg's London Argand, No. 0, *the very best burner yet constructed*,* and which gives its maximum of light when burning at the rate of five feet per hour—the gas being of 15 candle power. The following table shows the extraordinary change made by the apparatus upon the light of this burner when consuming gas in small quantities:

Pressure of the Gas as delivered to the Burner.	Consumption of Gas per hour.	Ill. Power *without Disc.*	Ill. Power *with Disc.*
		Calculated to 5 feet per hour. Compared with Sugg's London No. 1, burning 5 feet an hour, as 100.	
.064 in.	1.65 feet	7.36	63.5
.075 "	2.05 "	15.2	90.1
.1 "	2.4 "	30.7	93.3
.2 "	3.9 "	88.3	101.0
.25 "	4.5 "	103.9	Smokes.
.27 "	5.0 "	109.6	Smokes.

Here it is seen that in the initial experiment the application of the disc instantaneously increased the light from the gas *nine-fold!* And in the second experiment, the application even of this rude apparatus sufficed to develop from only *two* feet of gas an amount of light proportionably greater than is obtainable from ordinarily good argands (or any other kind of burner) when burning at the usual higher rates of gas consumption. So that the loss of light when gas is burned in small quantities, so far from being a fixed and constant quantity, is shown to be simply owing to the burner.

The Air-Supply.

The air-supply must give the exact quantity of oxygen required to consume the hydrocarbons and other vapor, and no more. This is a simple principle, but its practical application to gas burners involves several points of a complicated kind.

The air supply depends—first, upon the size and shape of the gas flame; in other words, upon the extent of surface which the flame from any burner presents to the air. The larger the flame (*cæteris paribus*), the larger the air supply—that is, the greater the extent to which the flame is brought in contact with the atmosphere. But, second, the mere size of the flame does not of itself fix the amount of the air supply. Of two flames of equal size, the air supply to the one may be much greater than to the other, for, upon the same area of flame, the draught or in-flow of air may be greater in some cases than in others. Hence the air supply depends upon two causes—first, the size and shape of the flame, and second, the draught upon the flame.

The influences which increase or diminish the draught upon a given size of flame are of a twofold character; they are produceable either by enclosing the burner (as with argands) so as to regulate the admission of air to the flame, or by the velocity with which the gas issues from the burner—in other words, they are dependent partly on the air supply and partly on the gas supply; and the latter is the more generally important as well as the less understood.

The draught or in-flow of air upon a flame of a given size depends greatly upon *the velocity with which the gas issues from the burner*. With argands there is a special means of regulating the air supply (viz., the chimney); but with all burners, whether argands or naked burners, the velocity with which the gas issues has an important influence upon the air supply; and in the case of naked burners (batwings and fishtails), this velocity of issue is, speaking roundly, the *sole* regulator of the air supply.

There is a striking difference of appearance between gas flames and what may be called *natural* flames—*e. g.* of burning coal or of a candle. The latter flames are more solid; they have less blue and more white than gas flames. This is owing, in the first place, to there being more carbon in these natural flames than in gas. Take the case of a candle, or of the flames from coal burning in a grate. In both of these cases, the whole of the light-giving vapors of coal are lost, being withdrawn by the condensing apparatus in the gas works. In an oil lamp or a candle, the *whole* of the illuminating vapors of the oil and the tallow go to form the flame. This is one cause of the difference between natural flames and gas flames.

But there is another matter which has to be taken into account. All *natural* flames rise into the air without "pressure," and simply by the twofold ascending power which they possess, 1° from the lightness of the illuminating vapors given off from matter by the application of heat; and 2° from the additional lightness which those vapors acquire from being *burnt* (whereby their temperature and consequently sparse-

* It is necessary to state that, notwithstanding the great care and skill with which Mr. Sugg constructs his burners, he has not yet succeeded in making them entirely uniform, so that some of these burners, although nominally alike, give appreciably different degrees of illuminating power.

ness are vastly increased). Hence the velocity, or upward rush, of natural flames is at a minimum, so that they come in contact with the atmosphere to the smallest extent possible. But with gas flames the case is different. The gas issues from burners under more or less pressure, so that the flame rises into the air not merely owing to its intrinsic lightness, but from a pressure from below which artificially increases the velocity of issue of the gas. This "pressure," as already said, is owing to the pressure which the gas has in the service pipes being allowed to pass into the burner. Moreover, the great majority of burners are so faultily constructed that a high pressure is actually *necessary* in order that the gas may be passed through the orifices of the burner in sufficient *quantity* as regards argands, or with sufficient velocity to give the desired *shape of flame* in the case of batswings and fishtails.

How Pressure Affects the Air Supply.

Gas to provide an adequate supply, must have some degree of tension or pressure. But with any given burner, when we want to burn more gas, we open the tap more widely; thereby we allow a larger portion of the pressure of the gas in the service pipes to act upon the burner; so that, although the orifices of the burner of course remain the same, a larger quantity of gas is passed through them.

As the pressure is increased, more gas issues from the burner, and consequently a larger supply of air is needed for the flame. Hence it may be thought that, although the increased velocity (due to the increased pressure) with which the gas issues from the burner augments the draught upon the flame, this will be balanced by the additional quantity of gas to be burnt, which of course requires an addition to the air supply. But this is not the case. The discharge of gas from the burner increases, not *pari passu* with, but only as tho square root of, the pressure. In this way the gas flame is brought in contact with more air than it is able to bear without loss of illuminating power, as a simple trial will show. Take a batwing or fishtail burner—say, one which does most justice to the illuminating power of the gas when burning at the rate of five feet an hour; then gradually open the tap, till the consumption rises to six, seven, or eight feet an hour. In spite of this great increase in the quantity of gas consumed, there will be very little (certainly no corresponding) increase in the size of the flame, and comparatively little increase in its illuminating power.

Effect of the Air Supply on the Illuminating Powee.

A gentleman of reputation as a chemist and scientific inquirer recently remarked to the referees that the more any one experimented with gas burners, the more he became aware how little is yet known upon the subject. The referees believe they have done much. But as a matter of science, there are still some points upon which they can as yet speak only suggestively.

It is said that the great loss or waste of illuminating power from the use of bad burners is occasioned by the gas being rapidly consumed, and that, in order to obtain the highest amount of illuminating power, the gas should be consumed in such a manner as to keep the gaseous atoms "as long as possible" in a state of incandescence. As a matter of fact this opinion is incorrect.

Take Sugg's London Argand No. 7. consuming five feet an hour of 16 candle gas. Without the chimney, we get a waving yellow flame about eight inches in height, and occasionally smoking. The gas, in fact, extends itself upwards until, by the size of the flame, it comes in contact with the air to the requisite extent to produce entire, or almost entire, combustion. Put on a chimney, of the most suitable kind for this quantity and quality of gas, and the height of the flame is at once *reduced by one half*, nevertheless the illuminating power of the flame is *increased by one half!* How is this? If, as is held, a slow rate of combustion were the best means of developing the illuminating power of gas, the tall flame which rises from an argand without the chimney ought to give the maximum of light. But, as already stated, the fact is otherwise. Being consumed in half the time, the gas flame rises to only one half its former height; but the increased intensity of combustion (in other words, the higher temperature at which the gas burns by obtaining an increased air supply) produces a greater amount of light from the shorter flame than from the taller one. Hence it is manifest that rapidity of combustion, so far from occasioning a loss of light, may—and in this case does—greatly increase the illuminating power of burning gas.

But if we still further increase the draught by using taller chimneys, a further diminution occurs in the size of the flame, which is not compensated by the increase of its brilliancy. And the explanation of these opposite results will, we think, throw an important ight upon the real cause of the startling diversity of lluminating power obtained from gas when consumed n different burners and under different conditions.

Up to a certain point an increase in the rapidity of combustion serves to increase the illuminating power—doubtless owing to the higher temperature of the gas flame so produced. On the other hand, beyond this point, the decrease in the size of the flame, owing to an increased draught upon it, is not compensated by the augmented brightness of the flame.

How is it that the increased draught upon the flame produced this effect? What is the true cause of the loss of illuminating power when a gas flame is exposed to an amount of air supply greater than what is necessary to produce complete combustion of the gas?

As is well known, the Bunsen burner, in which air is made to mingle with the gas before the point of ignition, gives a pale blue or violet flame which is almost lightless. But in proportion as the mingling of the air with the gas is diminished, by closing some of the holes in the stem of the burner, the flame becomes white and light-giving. A commingling of air with gas enormously diminishes, and may entirely destroy, the light-giving power of gas. And it may be inferred, *a priori*, that even when the gas is burnt pure, an over supply of air to the flame, by a sharp draught upon it, will tend to produce a similar effect, although in a much lesser degree. But in what manner is this effect produced?

The flame of the Bunsen burner has hitherto been regarded as the hottest of all gas flames. But this is not correct; for, in repeated experiments, we have seen a platinum wire melt in the blue part of batwing and fishtail flames (it is almost impossible to make the experiment with argands owing to the chimney), whereas the same wire did not melt in any part of the Bunsen flame. The special advantage of the Bunsen burner is that it gives a smokeless flame, and also that, by the intermixture of air, the gas is consumed within the smallest possible space; and *ceteris paribus*, the smaller the flame in which a given quantity of gas is consumed, the hotter will be the flame—more gas being burnt in the same space. At the same time, as already said, it seems obvious that owing to the intermixture of air with the gas, the flame of the Bunsen burner cannot possess as high a temperature as would be the case if an equal quantity of gas could be burnt pure in an equally small flame. The Bunsen burner consumes the gas in the smallest possible space—thereby concentrating the heat developed by the burning gas; but, on the other hand, the intermixture of air appears in some respects to alter unfavorably the conditions of combustion.

At an early stage of our experiments with burners, it was incidentally observed that the heat which Sugg's London argands gave out to a person standing on a level with or a little below them, was greater than that of inferior burners. And to test the accuracy of this impression, a thermometer was placed at a lateral distance of six and twelve inches from several different burners consuming the same quantity of gas. The results obtained were as follows:

Kind of Burner.	Ther. at a 6 inch's laterally.	Distance of 12 inch laterally.	Illuminating Power.
London Argand No. 1..	70. deg. F.	64. deg. F.	100
Sugg-Letheby.....	64°4 "	62.6 "	85.6
Bad Argand.....	59.5 "	58.0 "	34.5
No. 8 Fishtail	60.5 "	57.5 "	89.5
No. 4 Fishtail	61.7 "	59.5 "	62.7

In concluding these remarks upon the effect of air supply upon the illuminating power, the referees cannot but add that the question is one which is full of difficulties—hitherto baffling the ablest inquirers—and which they do not pretend to have wholly solved. The remarkable reduction in the illuminating power when gas is intermingled with even a small percentage of air is well known as a matter of fact, but no complete or satisfactory explanation of it has as yet been attained. That a reduction of the temperature of the flame must thereby be occasioned appears theoretically certain, and to some extent this is practically demonstrated by such experiments as the referees had the means of making. If a suitable pyrometer could be applied to gas flames, this point might doubtless be determined with exactitude; but even this would not wholly exhaust the difficulties of the question treated of in this section; and all that the referees hope for and expect is, that the above remarks and experiments may smooth the path for future inquiries.

[To be concluded.]

Court of General Sessions of the Peace.

New York County.

The People of the State of New York against The President, Directors and Company of the New York Gas-Light Company.—The indictment against the above named defendant, coming on for trial in this Court, September 21st, 1871, before Hon. Gunning S. Bedford, City Judge, as presiding Justice thereof, and a jury; it was proved, on the part of the people, that odors and stenches, believed to be injurious to health, and supposed to arise upon the works of the defendant, pervaded, from time to time, certain portions of the city. It was proved on the part of the defendant, and conceded by the District Attorney on behalf of the people, that the defendant was, by the Act of the Legislature of the State of New York, passed March 26th, 1823, authorized to manufacture, make and sell gas in the city of New York; that the defendants' works were erected and maintained in their present position by the license of the Mayor, Aldermen and Commonalty of the city of New York, at a cost of over $2,500,000. That such authority and license were in force during the period laid in the indictment. That no one of the complainants had lived or owned in the vicinity, previous to the erection of defendant's works. That the works of the defendant were originally constructed in the best manner then known; that the defendant used due care and diligence in the manufacture of gas; that its workmen were competent, and that from time to time the defendant had introduced such improvements and discoveries as were made in the apparatus and process of the manufacture of gas. That the defendant by means of its works supplied 15,000 customers and 3,300 street lamps in the city of New York, and that it would not be practicable to supply gas to the city of New York by means of works removed from it. That there was no improvement or method known to art or science, by which the manufacture of gas could be conducted in the city of New York with less public inconvenience than the defendant occasions.

At the conclusion of the testimony the Court charged the jury.

Gentlemen of the Jury: In order to render a verdict for the people in this case, you must be satisfied beyond all doubt; first, that the odors complained of emanated from the buildings belonging to the gas-light company; second, if you find that the odors emanating from the gas-light company prove disagreeable, and are an annoyance, calculated to interrupt the public in the reasonable enjoyment of life or property, by creating an unwholesome smell, thereby rendering the enjoyment of life and property uncomfortable (although the business which is being conducted was and is a lawful one). If you find these facts from the evidence in this case, beyond a reasonable doubt, then I charge you, as matter of law, that the defendants are guilty of carrying on the nuisance for which they have been indicted.

The counsel for the defendant excepted to the second clause of the charge, unless it should be qualified by adding thereto the words, "Provided such business, being authorized by law, is not conducted in the most approved manner known."

The Court declined to charge otherwise than had already been done, and the defendant duly excepted.

The defendant then requested the Court to charge the jury.

First.—"That if the damage complained of was slight, uncertain, and rare, the jury are to find the defendant not guilty."

The Court declined so to charge and the defendant duly excepted.

Second.—"That the manufacture of gas by the defendant being authorized by the Legislature, cannot be held a public nuisance, unless it is clearly shown that the defendant has failed or neglected to adopt some material and generally accepted improvement in the means or method of manufacture, and that unless the jury find that there has been such neglect and failure on the part of the defendant, the verdict must be not guilty."

The Court declined so to charge and the defendant duly excepted.

Third.—"That if the works of the defendant were originally constructed in the best manner then known, and have been, from time to time improved, in accordance with the discoveries and inventions made; and if the defendant has used due care and diligence in the manufacture of gas, the jury in so finding must return the verdict of not guilty."

The Court declined so to charge and the defendant duly excepted.

Fourth.—"That if the commodity furnished by defendant is a public necessity, and it is not probable that this commodity can be supplied with less public inconvenience than the defendant occasions, even independently of the statute, the defendant is protected in its manufacturing and distributing process, and if the jury believe this to be the fact, the verdict must be not guilty."

The Court declined so to charge and the defendant duly excepted.

Fifth.—"That the defendant has full power and authority to manufacture, make, and sell gas to be made of coal, oil, tar, peat, pitch, or turpentine, or other materials, and to be used for the purpose of lighting the city of New York and the streets thereof, and in buildings, manufactories or houses therein con-

tained and situate, and had such power during the period laid in the indictment."

The Court so charged, with this explanation to the jury, that "They (the defendants) assume the responsibility of its being prejudicial and creating a nuisance. They (the defendants) have the right to carry on the business, but they assume the responsibility for anything that may prove a nuisance to the neighbors."

The defendant duly excepted to this qualification or explanation of the charge requested by him.

Sixth.—"That upon the whole case the jury should find for the defendant."

The Court declined so to charge and the defendant duly excepted,

Professors Chandler and Wurtz testified as experts on behalf of the defendant.

John R. Fellows, Esq., Assistant District Attorney, appeared on behalf of the people.

Francis Lynde Stetson, of Hascall & Stetson, appeared for the company.

The Jury returned a verdict of guilty, but sentence is suspended until the Supreme Court shall pass upon the Bill of Exceptions made up by the defendant's counsel.

Gas Works in the West Indies.

Works for lighting the City of Kingston, in the Island of Jamaica, have for some time been under discussion, and various proposals were offered to the Colonial Government by parties in this country as well as England. The following letter will show the latest phase of the business:

COLONIAL SECRETARY'S OFFICE.
July 22d, 1871.

Sir: Adverting to previous correspondence upon the subject of supplying the City of Kingston with gas, I am to request that you will acquaint the Municipal Board that after carefully reviewing and considering all the projects that have been brought forward by different persons, the Governor has come to the conclusion that the most certain and satisfactory arrangement, and by far the most economical, will be the establishment of gas works by the Government, which, at least until the original outlay shall be repaid, will remain under Government control.

The most favorable offer that has been received from any private individual, whether on behalf of an existing or projected company or otherwise, would result in a charge on the public, and on private consumers of nearly double the amount of what it is believed, would be found a sufficient remunerative price if the undertaking were carried out by the Government.

From a report on the subject and an estimate of the cost of the undertaking made by the Director of Roads and Surveyor General, it is ascertained that the cost of each lamp per annum lighted in the public streets on an average of six hours each night, would be about five pounds. Col. Mann estimates that about three hundred lamps are required to light the whole of the Kingston streets; this would consequently entail an annual expense of about £1,500. But should it be thought unnecessary to light the whole of the streets, the number of lamps might be considerably reduced, and the annual charge proportionately lessened.

The Governor would therefore be glad if the Municipal Board would take the matter into consideration, and advise him as to whether the people of Kingston are prepared to provide the funds required to defray the cost of lighting the streets, in a more or less complete manner; also to what extent they would think it advisable to carry the lighting, should any degree of lighting be acceptable, and in what manner the Board would recommend the requisite impost to be assessed so as to bear equitably on all in proportion to the benefit received.

As to the degree of lighting, it occurs to the Governor that perhaps it may be prudent to commence on a low scale. Perhaps one light at every street corner, with the thoroughfares and streets on which warehouses and shops abut, completely lighted, would sufficiently answer the purpose at first. In this way a large reduction of the 500 lamps might be possible, which the Board may be able to estimate.

As to the lighting tax which will be necessary, the Governor is inclined to think that the most equitable impost, and the one easiest levied would be a per centage on the rental, leviable from the landlord, who would have the right to recover the amount from his tenant, by an increased rent.

The Governor feels that he need not remark to the Board on the great advantage which the town will derive from being lit, its present state being anything but creditable. If it is to be lit at all, the cheapest and best method is certainly by the use of gas.

I have the honor to be, Sir,
Your obedient servant,
WILLIAM A G. YOUNG.

A. N. CARDOZO, Esq., Clerk Municipal Board, Kingston, Jamaica.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—EDS.

Answer to John Gwynn.

NEW YORK, September 26, 1871.

Mr. Editor: Without noticing the introductory remarks of your Tiffin correspondent, who I trust will feel your just rebuke, I will proceed to answer his letter of August 29th, and in doing so I will endeavor to steer clear of the irrelevant matter which his whole communication is seasoned with.

First—He takes exception to my remarks, which, to use his own words, he flatly denies, and the very next moment he admits the truth of my assertions.

Second—His sophistry is ingenious. He wishes to know "If a meter has been proved in a dry condition of apparatus, after being on the meter makers' shelves, etc., what would be the result?" Just what I have stated. In legal phrase it is, that is my case.

Now, friend Gwynn, *that is a little too thin.* You know, or ought to know, that all the testing a meter gets is at the hands of the maker, when it is in the best possible condition for the companies interests, and must be tested before it is completed, as to alter it would necessitate taking it to pieces. All that is required next is to purchase a badge from an inspector and attach the same to the meter; the meter is then complete, so that upon the meter maker rests the whole responsibility whether the meter is a correct measure or not. The old shoe paragraph is irrelevant, and needs no answer further than I may say, the inspectors pretty soon find out any defect on their side of the question.

I would also remark, I had no idea of ignoring the wet meter, but thinking "sufficient for the day was the evil thereof," therefore did not refer to it in my former communication, but will do so now to please Mr. Gwynn, who wishes to put words into my mouth and make me say Yes when I intend to say No. I am sorry I cannot endorse his opinion, even on wet meters. The fact is, Mr. Gwynn, there is too much human nature in both wet and dry meters, and that man who can make a perfect instrument (which in gas meters is thoroughly practical—thanks to the great minds who have devoted fortunes and lifetimes to its accomplishment), can also make the same a *fraud*, with but little fear of detection.

Has Mr. Gwynn ever heard of the long spout wet meters, that would allow an over-filling of 25 per cent. If he has not, allow me to tell him they were not uncommon in England before the passing of the Meter Act of 1859, which same Act gave the dry meter the ascendancy. Again, the gas companies take care of the water arrangement, and impress upon their customers the importance of keeping up the water level, omitting the information that an excess of water means short measure in gas.

Relative to the State Inspectors at the expense of the gas companies, I would inform Mr. G. I am fully conversant, and my opinion is unchanged by the knowledge.

Paragraph number four, I must say, shows an amount of recklessness seldom met with on scientific subjects, when he asks you to supply burners to test meters by, showing plainly what a vague comprehension he must have, when it is well known that a burner's consumption is governed by the pressure; a six-feet burner at 4-10ths pressure will burn double this amount at 10-10ths. I leave you to judge what kind of an approximation to a meter's correctness can be obtained from Mr. G.'s "practical suggestion."

In conclusion, I would say, what I have written I am always prepared to prove, and until a proper meter enactment, similar to the English Act of 1859, is in operation on this Continent, the public have no safeguard, nor can they be expected to endorse an instrument, the correctness of which they have no equitable means of ascertaining.

I can scarcely understand why Mr. G. should close his remarks with referring to you about my improvements for dispensing with the hydraulic main, stand pipes, etc., but I will promise, as soon as I have completed my arrangements for the manufacture of said improvement, Mr. G. shall not be excluded from its benefits, and the cost shall be 50 per cent. less than what it now costs for hydraulic main, stand pipes, valves, etc.

Relative to the mischief I have caused in awakening the public mind (which, by the way, I think is only in Mr. G.'s imagination), I can only say it is better for the gas companies interests to have a reliable meter which has the public confidence, than for them to appear, as they certainly do, as public robbers. Waiting for further developments.

Yours very respectfully,
JOHN KEELING.

Nickel Plating.

The advantages of electro-plating with nickel are; First, that the coating of nickel is quite hard, nearly as hard as iron, so that it keeps its polish much better than Britannia metal or any other similar tin alloy—even better than brass or silver; secondly, that it adheres well, even when put on in thick layers, so that it may be easily polished; and then has a shade between that of polished steel and that of alloy of silver and copper; thirdly, that it requires no lacquer or varnish, since it does not tarnish by exposure to the air, as brass does, and even silver, when exposed to the least trace of sulphurous vapors. It retains its lustre for a very long time, being proof against oxidation under ordinary circumstances; wherefore Richter counted nickel among the noble metals. It only oxidizes at a red heat when in contact with air; when air is excluded, heat reduces its oxide to the metallic state. Plating with nickel is accomplished like other electro-plating, only the bath or nickel solution is prepared in a peculiar way. The simple soluble salts of nickel appear not adapted for the purpose; double salts are required. Becquerel, the great French chemist, prescribes a solution of the double sulphate of nickel and potassa; this solution is not patented, and may be used by every one. Mr. Adams, of Boston, patented the use of the double chloride of nickel and ammonium, or the sulphate of nickel and ammonium; the specialty on which his patent mainly rests is the careful exclusion of potash, soda, or their equivalents, caused by his erroneous supposition that the smallest quantities of potash or soda would prevent the success of the operation. Probably this error proceeded from the observation that potash or soda reduces solutions of nickel salts, and precipitates nickel in the state of a hydrated oxide; the acid of the nickel salt combining with the alkaline base. But a part only of the nickel solution can be thus reduced; and the precipitate is easily dissolved again, or its formation prevented by the addition of a proper amount of the same acid in a free state. Moreover, when carbonate of potash or soda is used for forming this precipitate, a portion of it will be re-dissolved by a concentrated solution of these carbonates. It is clear that nickel-plating in general cannot be patented.—*Manufacturer and Builder.*

The fineness of pulverization is excessive, and cannot be attained by any other known apparatus. It is apparently accomplished by the mutual attrition of the particles of coal, as there is no friction of iron surfaces or grinding action by the pulverizer. A cubic inch of coal presents six square inches of surface to the action of heat. The distillation of gas and combustion of the solid coke of bituminous coal in the lump is consequently slow, and subject for a long period of time to the causes of waste. After passing through the above-described air-mill of Messrs. Whelpley and Storer this same bulk of carbon will have its surface extended from six square inches to forty square feet, and a considerable portion will have been so finely divided as to present 200 square feet of surface to the cubic inch of solid.

Instantaneous and perfect combustion, with a proper supply of air, for carbon in this condition, is a matter of course, the gas and coke burning in swift succession. An expanding flame is produced of extreme and almost uniform intensity. Metal heated and worked under such a fire is free from particles of carbon and cinder, the generator sending over only a small volume of hot gases, and the entire body of ash passing with the draft into the ash-pit beyond the flue bridge. The texture of the rough or muck bar thus produced is uniform, whether made from scrap or pig metal, as there is no imperfection caused by unequal heating, oxidation, or ash.

The Nature of Different Gums.

Dr. Sacc, of Neuenberg, Switzerland, has made an extensive inquiry into the nature of different resins. We condense from it the following results:

The resins spoken of are copal, amber, dammar, common rosin, shellac, elemi, sandarac, mastic, and Caramba wax. All these resins can be reduced to powder.

The following will become pasty before melting: Amber, shellac, elemi, sandarac, and mastic; the others will become liquid at once.

In boiling water, Caramba wax will melt; common rosin will form a semi-fluid mass; dammar, shellac, elemi, and mastic will become sticky: while copal, amber, and sandarac will remain unchanged.

Dammar and amber do not dissolve in alcohol; copal becomes pasty; elemi and Caramba wax dissolve with difficulty; while rosin, shellac, sandarac, and mastic dissolve easily.

Acetic acid makes common rosin swell; on all the others it has no effect.

Caustic soda dissolves shellac readily, rosin partly; but has no influence on the others.

Amber and shellac do not dissolve in sulphide of carbon; copal becomes soft and expands; elemi, sandarac, mastic, and Caramba wax dissolve slowly; while rosin and dammar dissolve easily.

Oil of turpentine dissolves neither amber nor shellac, but swells copal; dissolves dammar, rosin, elemi, sandarac, and Caramba wax easily, and mastic very easily.

Boiling linseed oil has no effect on copal, amber and Caramba wax; shellac, elemi, and sandarac dissolve in it slowly, while dammar, rosin, and mastic dissolve easily.

Benzole does not dissolve copal, amber, and shellac, but does elemi and sandarac to a limited extent, and Caramba wax more easily; while dammar, rosin, and mastic offer no difficulty.

Petroleum ether has no effect on copal, amber, and shellac; it is a poor solvent for rosin, elemi, sandarac, and Caramba wax, and a good one for dammar and mastic.

Concentrated sulphuric acid is indifferent to Caramba wax; it dissolves all resins, imparting to them a dark brown color, excepting dammar, which takes a brilliant red tint.

Nitric acid imparts to Caramba wax a straw color; to elemi, a dirty yellow; to mastic and sandarac, a light brown; it does not affect the others.

Ammonia is indifferent to amber, dammar, shellac, elemi, and Caramba wax; copal, sandarac, and mastic becomes soft, and finally dissolve; while rosin will dissolve at once.

It is not difficult, by means of these reactions, to test the different resins for their purity.—*Dingler, Polytech. Journal.*

Prescriptions for Doctoring Iron.

The powder composed by Schafhautl, consisting of common salt and oxide of manganese, was one of the most popular compositions of this kind; its action was supposed to be due to the chlorine and the sodium in a nascent state. Next came the litharge, or oxide of lead process, relying upon the affinity of lead for sulphur and phosphorus at a high temperature. After the invention of the Bessemer process, hydrogen, chlorine, and carburetted hydrogen were tried in succession and blown through the converter, but without any favorable result. The Heaton process effected the purification by means of nitrates, but it proved, however, too expensive for commercial work. Mr. Bessemer at one time expressed an opinion that the removal of some noxious elements might be effected in the converter if the decarburization could be so protracted as to give a sufficient time to the other elements to combine with the oxygen of the blast. With a view to produce this result, the employment of hydro-carbons, naphtha, charcoal powder, graphite, and other carbonaceous matter was tried in the Bessemer process, but no good resulted from all these experiments. M. Berard proposed to use the carburizing influence of a flame overcharged with gas in a Siemens furnace, for the purpose of keeping his bath of pig iron under the action of his process for a protracted period; but M. Berard did not succeed in practically working out his ideas.

Inventors next turned to the refining process as a preliminary for the manufacture of malleable iron and attacked the impurities in that stage of the process of manufacture. Mr. Palmer Budd runs his pig iron over beds composed of oxide of iron and of nitrates; M. Ellershausen mixes the pig and the oxide of iron into the form of sandwich cakes; but from all this applied ingenuity there has resulted nothing of value for metallurgical practice.

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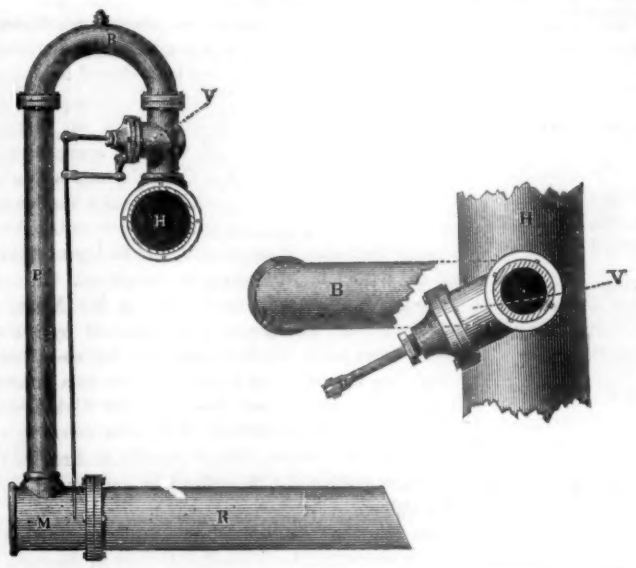

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General Editorials.

OHIO CANNEL IN THE NEW YORK MARKET.

Mr. George R. Tuttle, of Cleveland, Ohio, through the agency of Mr. George Merryweather, of No. 5½ Pine St., has lately introduced to us an Ohio Cannel, and will henceforth furnish this very rich material to gas companies on terms which, as we are assured, will be acceptable. The reputation of the Ohio Cannel seam is familiar to the fraternity; but this material has been regarded as economically unattainable on the Atlantic seaboard. It rests with Mr. Merryweather and his associates, to prove the contrary.

We have procured, from one of Mr Merryweather's coal yards, samples (selected by ourselves, from a lot of 1,500 tons) of the so-called "Sterling Cannel," and submitted it to a practical analysis at the works of the New York Gas-Light Co. The experimental apparatus of this Company has been recently repaired and refitted with care and skill. We cite the condensed results below.

The Sterling Cannel is generally somewhat slaty in structure, tough and splintery in fracture, clean and entirely free from dust or slack. Crucible analysis in the ordinary way, in the closed crucible, gave

Coke	59.36
Volatile	40.64

On coking in an *open* crucible, however, which is our favorite practice, having always found this *modus operandi* far more satisfactory, in its approximation to practical results in the gas retort, we obtained

Coke	51.26
Volatile	48.74

Weighings of the coke from three of the subsequent practical experiments in the retort, gave 50—50—52.5—in the mean 50.7, agreeing closely enough.

The volatile matter comprehends 1.31 per cent. of moisture. Incineration of the coke yielded an ash equal to 14 per cent. of the coal. Therefore, the Sterling Cannel has the composition

Fixed Carbon	37.26
Volatile Matter	47.43
Ash	14.00
Moisture	1.31
	100.00

As already mentioned, we have had the privilege (it should be added, through the kindness of Mr. Mowlton, the Superintendent) of making these tests at the New York Gas Works. We worked off in all 27 charges (of 2.25 lbs. each) in two series of experiments, in the first of which series (comprising seven charges) a trial was made of purifying the gas with lime, and in the second (20 charges) with the highly improved iron mixture of St. John and Cartwright:

Lime, purified per bushel	1536 cub. ft.
St. J. and C's Iron Mixture purified per bushel	3840 cub. ft.

It is to be pointed out, however, that these numbers must be regarded only as comparative, or relative, for, on the large scale, both methods would do far better. In fact, in this coal, so far as the eye can judge, sulphur is not abundant, though strings and bunches of pyrites appear.

In the two series of tests with lime and iron purification there was no appreciable difference in candle power, when the same volume of gas was drawn off from a charge. This may call for explanation, as it is generally accepted that iron leaves some carbonic acid in gas, which should take something from the candle power. The answer is that in gases so rich as this, the impoverishing action of inert mixtures, like air or carbonic acid, becomes inappreciable. According to investigations of our American gas chemist Carl Schultz, made many years since, (which we cannot just now spare space to reproduce in full) gas that yields over 20 candles is even improved by admixture with small proportions of air. We may then readily believe that one or two per cent. of carbonic acid in a 25 or 30 candle gas may not be appreciably hurtful. We have as yet no analyses of gases from Ohio cannels, but it may be said, referring back to previous articles in this Journal, setting forth the meagre data we have about gases from American coals, that it is not improbable that American cannels, like American caking coals, may yield gases comparatively deficient in carbonic acid.

However this may be, we find that we must state, as a fact, that in every case, a larger volume of gas was obtained with the use of St. John and Cartwright's composition than with lime. We found also that the better the heat the larger the volume of gas, with little or no diminution of candle power; and with still better working heats than we were able to obtain in these experiments, it is our belief that this coal would show still better. To come, however, to the actual figures got by us; we will cite here four experiments with gradually increasing heats.

	Feet per lb.	Reduced Candle Power, 10 observations each.
1.	3.16	30.4
2.	3.51	28.5
3.	3.75	28.0
4.	4.05	28.0

This gas of course could not be fairly tested with the ordinary test argands, and after some preliminary experiments a large batwing burner was selected and used in the above tests. This smoked somewhat, still showing that the full power of the gas was not developed.

It appears reasonable to admit, for the capacity of the Sterling Cannel, at a good working heat, in the bench, 4 feet of 30 candle gas, equivalent to 10,000 feet per ton of about 27 candles. The proportion of volatile matter is nearly equal to that assigned in the books to the Lesmahago cannel, 49½ per cent., a coal which is rated at about 10,000 feet of 29 candles.

Another unexpected and remarkable result of our analysis remains to be mentioned. The *coke* was found to be fair in quantity and large in volume. This is so unusual with American cannels that it deserves special notice; 20 of the above charges gave, collectively, coke equal to 50 bushels per ton.

Doubtless the smaller comminution of the coal, for the smaller apparatus, had its effect here, and we would not recommend the calculation of more than 45 bushels of coke to the (long) ton. In admixture with good caking coals, the Sterling will give excellent cokes. The ash will not clinker.

PRESIDENT GREENOUGH'S ADDRESS; SPECIAL EDUCATION IN GAS SCIENCE.

In this number we have the pleasure of introducing in full the able and interesting address of Mr. Greenough, President of the Boston City Gas-Light Company, before the New England Association of Gas Engineers. The train of thought which he presents is very similar to what has passed through our own mind when consid-

ering, as we often do, the manifold and complex, sometimes apparently conflicting duties and responsibilities, relating to both his employers and the public, that weigh on the shoulders of the manager of a gas works. And, moreover, Mr. Greenough has come to conclusions substantially very like our own, as previously set forth in these columns, regarding the growing, in fact we think the crying, necessity of special education and training for young men who are to fulfill these important duties. Our editorials in support of a movement for a School of Gas will be remembered. Mr. G., after concluding that "it would be well that young men might be duly qualified by a course of study and experimental work for the profession," hopes "that a chair of experimental physics may be endowed in some one of our institutions, under which instruction may be given in our specialty," and so on.

Right glad are we that a gentleman of such eminent position, both in social life and in the gas fraternity, has put his shoulder to the wheel in this new movement. It gives us an assurance that the movement can be made and will become a substantial one, as based on a real want of the age. Nevertheless, we must take the liberty to point out that Mr. Greenough's suggested mode of meeting the case is not, if we read him aright, wholly in accordance with his own statement, of what is desiderated. A professorial chair in one of our existing colleges, no matter how worthily or eminently filled, could not in itself conduce to "a course of study and *experimental work*" on the part of those to be trained for the profession. The kind of experimental work required, as it appears to us, is in the gas house itself, and we think that this would hardly be practicable without a model gas works. Besides, it does not appear to us well, probably not practicable, that the curriculum to which students of gas ought to be subjected, should be involved in, or connected in any way with, those of our ordinary academical institutions. There are the same (probably stronger) reasons as in the case of Agricultural Schools for example, why a School of Gas should be a unit in itself. No more than an ordinary common school education should be required, or would be needed, as a preparatory qualification. (Into this we shall enter again). We therefore adhere still to our former idea of an independent special School of Gas, endowed with every means for scientific and practical education in Mathematics, Mechanics, Chemistry, and Practical Gas Making, located in close proximity to such large centres of population as will afford the student conveniences for ready access to, and study of, the largest possible number and variety of actual manufacturing apparatus. We will here add an idea which we have not before thrown out, that if it be regarded (though this is to us doubtful) expedient to enlarge the scope of such a school, there are other specialties which naturally work in with that of gas, namely, the mechanics and chemistry of water-supply, drainage and sewerage, heating and ventilation, and so forth.

We shall also say that we have on foot plans that we regard as practicable for the establishment and endowment of such a school, which will be duly developed when the proper time arrives.

THE ATTACK ON THE NEW YORK GAS-LIGHT COMPANY.

In other columns will be found that we have procured a complete account, so far, of the prosecution commenced in a Criminal Court in this city, against the New York Gas-Light Co., as a nuisance! The essential history of the case is there fully told up to date, and we have at this time little to say, reserving comment until the final decision. Attention should be directed, however, to the vital importance, to *all* Gas Companies, of the questions here brought up. According to the verdict already procured, if it can be sustained, and should be acted on, Gas Works could exist *anywhere* only *on sufferance* on the part of the public. As to our city companies, were it possible to realize the chimerical notion sometimes broached, to remove them all from off the Island, would they not become in any other location that could be found, legitimate, or rather legalized, subjects of oppression, taxation, blackmailing and extortion? Let us possess our souls in patience, and see what the end of these things shall be.

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JOHN P. KENNEDY, Chief Engineer.
LEONARD D. GALE, Consulting Chemist.

GENTLEMEN: We beg leave to inform you, that we have purchased the Patent process for making ILLUMINATING GAS from PETROLEUM and its products, known as the

GALE and Rand Patents,

and we are now prepared to treat with you for the use of said process by your Company.

We are also prepared to contract for putting said process into successful operation in your works, furnishing all the necessary plans, materials, and workmen for that purpose.

We do not deem it necessary to enter upon a detailed description, here, of the processes above referred to, deeming it sufficient to state, to secure your interest and investigation, that they have been in successful operation, for months, in a number of Gas-Light Works in the United States, and are now being introduced in the works of the Mutual Gas-Light Company, of New York City; the Citizens' Gas-Light Company, of Brooklyn; the New Orleans, San Francisco, and very many other Gas-Light Companies throughout the country.

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GAS SCREEN MANUF'G COMP'Y.

LETTERS OF INTEREST TO GAS LIGHT COMPANIES and Superintendents of Gas Works needing new Gas Trays, or Screens, for another season.

Which are the best and cheapest?

We refer to over sixty companies *now* using them.

BROOKLINE, June 17, 1871.

E. DUFFEE, ESQ.:

Dear Sir: You will please make a set of Gas Trays for this Company as soon as convenient, at price named.

In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country.

Respectfully Yours,
H. A. ALLYN,
Superintendent Brookline Gas-Light Co.

EAST BOSTON, June 15, 1871.

Gentlemen: We have used your Screens some five years they give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen.

Yours truly,
A. M. NORTON,
Supt. East Boston Gas-Light Co.

CHELSEA, May 1, 18[illegible].

Mr. E. DUFFEE:

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly,
JOHN ANDREW, Supt.

JAMAICA PLAINS, MASS., June 21, 1871.

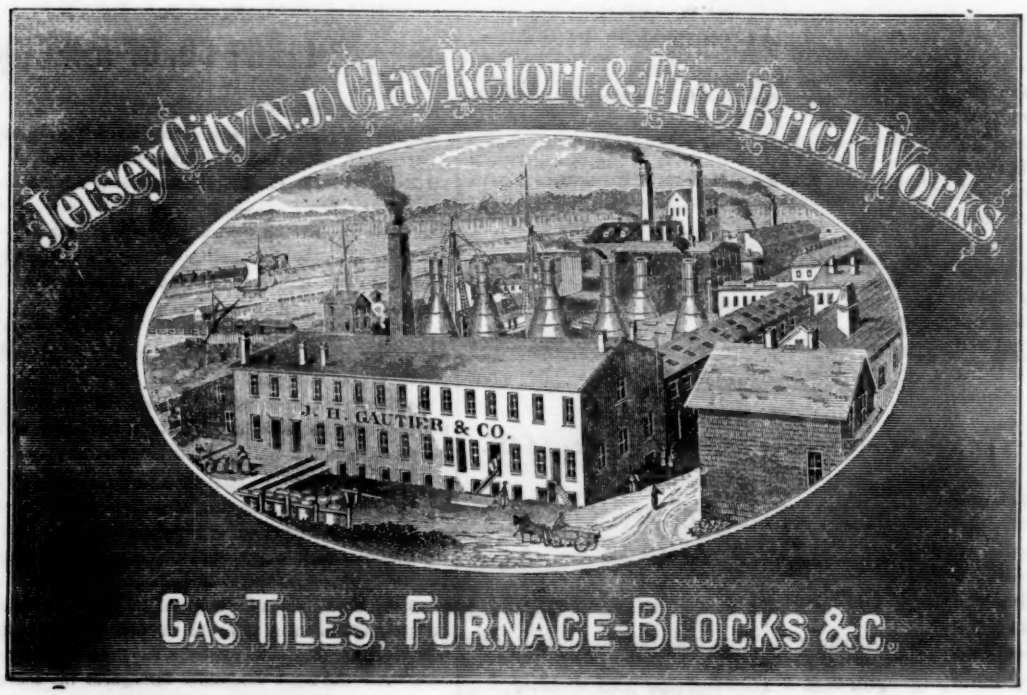
EDWARD DUFFEE, ESQ:

Dear Sir: The Trays ordered by this Company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige. Yours truly,
JAMES F. ROGERS,
Supt. Jamaica Plains Gas-Light Co.

Also see letter from Providence, R. I., in another column.

It will be for the interest of all Gas-Light Companies needing new Trays another season, to give their orders early, to be delivered where wanted, as we were unable to fill orders promptly to Companies ordering late last fall.

American Gas Screen Man'f'g Company,
Haverhill, Mass. 246-3m



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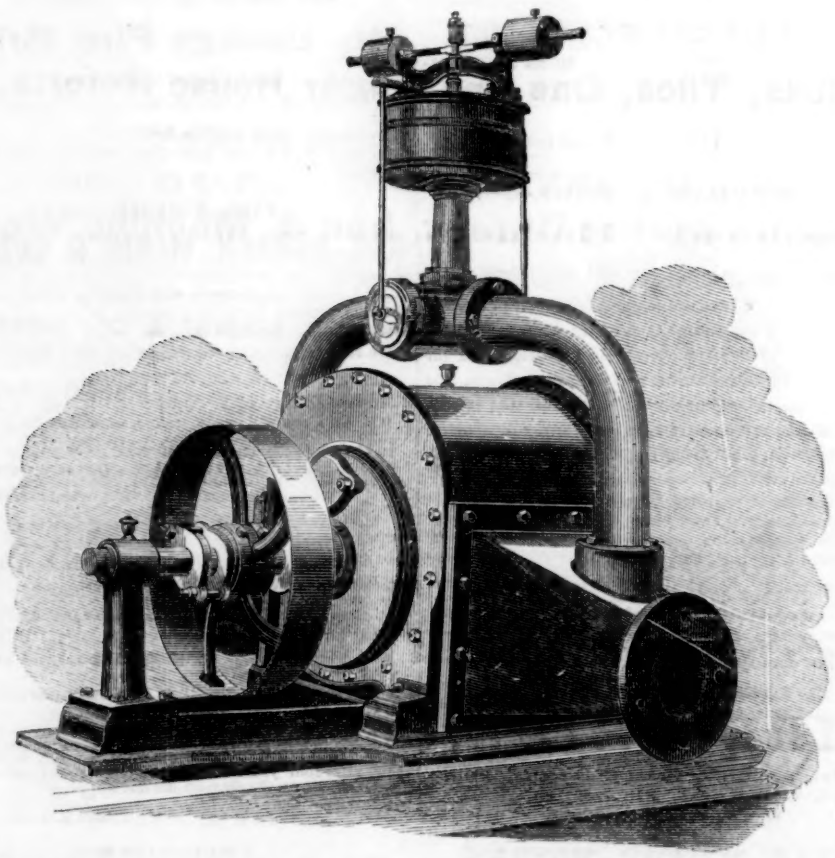

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its ration.

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The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the rdinary Fan. The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time quired by the old style Cupola, and 33 per cent fuel. Address

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J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,
LUCAS FLATTERY,
Sec'y Wooster Gas-Light Co.

Address the Patentee,
J. W. GRAHAM,
Chillicothe, Ohio.
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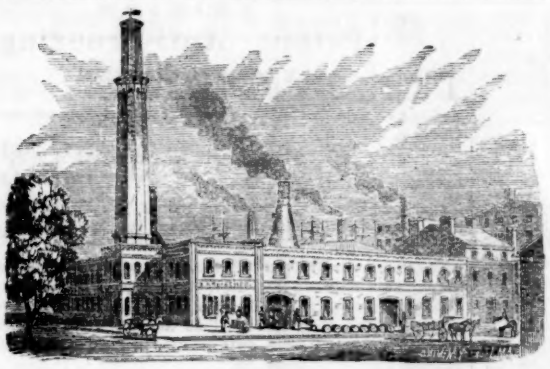

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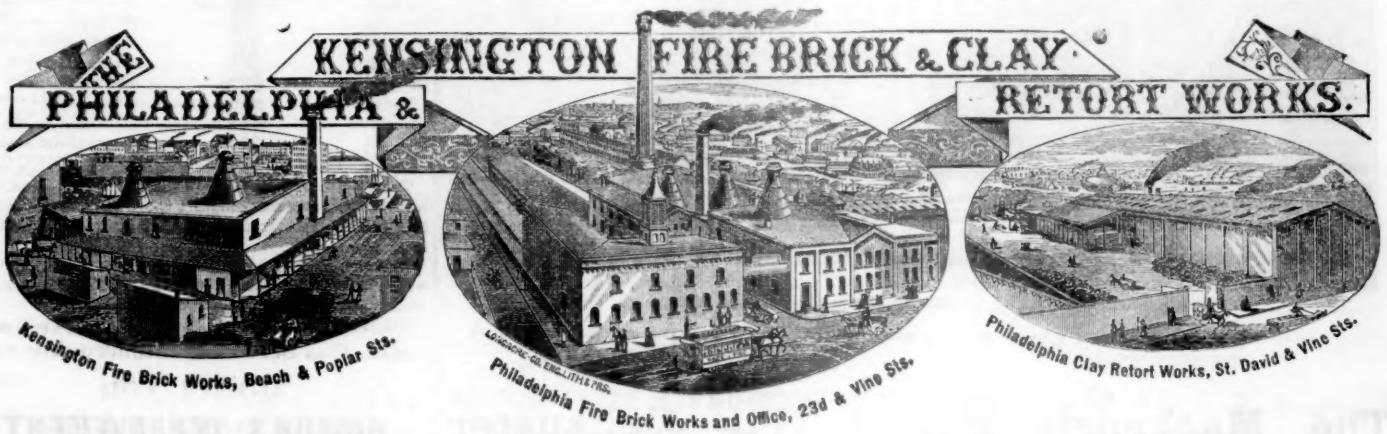
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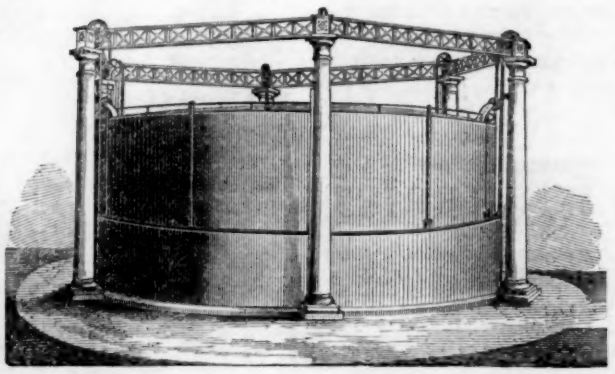

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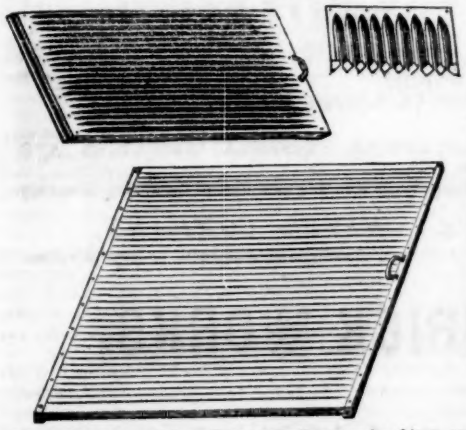

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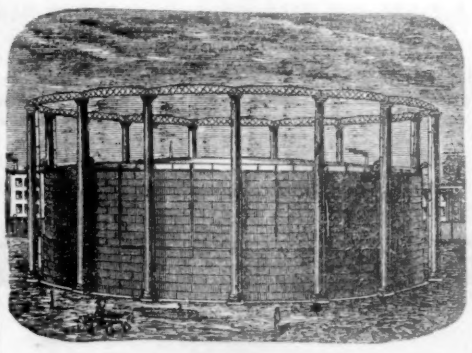

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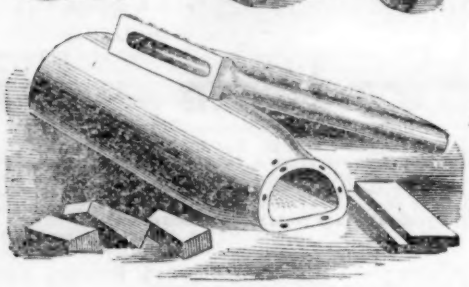

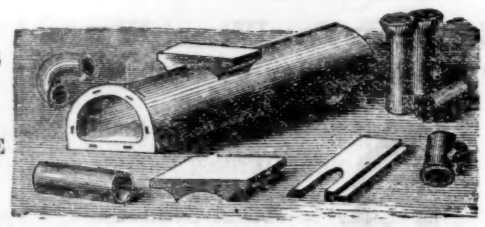

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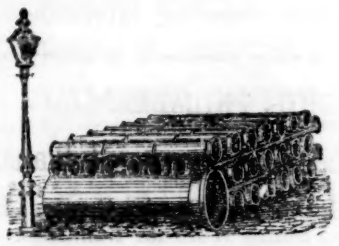

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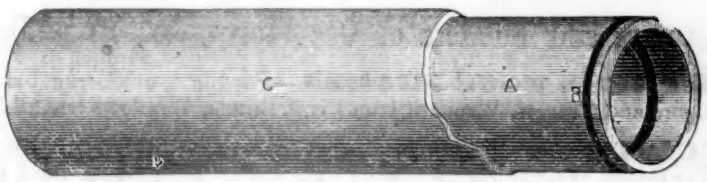

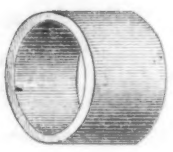

Fig. 2.

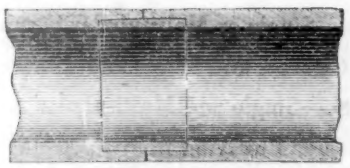

Fig. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

Fig. 2.—Thimble for Connection. Fig. 3—Horizontal Section and Connection.

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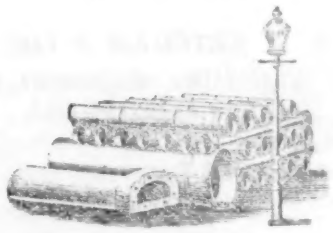

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